Exploring Source Credibility when Communicating about Agricultural Science on Twitter

Allison R. Fortner
University of Georgia

Alexa J. Lamm
University of Georgia

Abigail Borron
University of Georgia

See next page for additional authors

Recommended Citation

Fortner, Allison R.; Lamm, Alexa J.; Borron, Abigail; Holt, Jessica; and Moore, Allen J. (2022) "Exploring Source Credibility when Communicating about Agricultural Science on Twitter," *Journal of Applied Communications*: Vol. 106: Iss. 3. https://doi.org/10.4148/1051-0834.2436

Exploring Source Credibility when Communicating about Agricultural Science on Twitter

Abstract

Universities must strategically communicate agricultural science to effectively reach millennials skeptical of agricultural innovations and constantly assessing the credibility of online information. Universities are trusted information sources and must maintain credibility on social media platforms such as Twitter, used by millennials to receive and share information. Source credibility seeks to understand message source and recipient characteristics that influence recipients' perceptions of a source's expertise and trustworthiness. The purpose of this study was to explore differences in engagement when specific factors affecting source credibility were emphasized when communicating with millennials about agricultural science on Twitter. The purpose was accomplished by describing the level of engagement and the differences in engagement observed between perceived gender, race, and age of university scientists. Over seven months, researchers wrote press releases about published journal articles authored by two or more diverse, university-affiliated scientists. They published multiple tweets about each release, with the only difference being the scientists' headshots. Scientists were categorized as perceived male versus female, White versus Non-White, and older versus younger. Descriptive analysis of engagement metrics from 32 tweets found those with females performed better than those with males. Non-White scientist tweets performed better with the exception of engagement rate. Tweets featuring younger scientists received more engagement than older. The exploratory results implied tweets featuring young, Non-White females may elicit higher engagement. Future studies should examine if engagement metrics are correlated with source credibility dimensions. Strategically featuring diverse scientists in research communication may be utilized to build engagement in universities' social media.

Keywords

source credibility, agricultural science communication, Twitter, university communication, millennials

Cover Page Footnote/Acknowledgements

Authors

Allison R. Fortner, Alexa J. Lamm, Abigail Borron, Jessica Holt, and Allen J. Moore

Introduction

The complexities of public information processing and scientific trust present a challenge for agricultural science communicators to share evidence-based information effectively and strategically with target audiences in a manner perceived as trustworthy. Strategic communication is increasingly complex as new technologies emerge and members of the public are faced with novel information and asked to trust experts in uncharted territory in which the consumers themselves have no "experience or direct knowledge" (Lang, 2013, p. 145). Additionally, while the public may trust scientists to deliver accurate information about the effects of agricultural technology on the food supply (Martin et al., 2016), they are more skeptical about the effects of GM foods on people and the environment, perhaps because of narratives of corporate power associated with GM foods (Hunt & Wald, 2020).

In addition to public distrust of some aspects of agricultural science, younger audiences tend to be more skeptical than their older counterparts about advances in agricultural technology (Hunt & Wald, 2020). Younger generations, such as millennials, hold strong opinions and are active in issues concerning agricultural advancements and the environment (Burke et al., 2020; Smith, 2010; Smith & Brower, 2012). Millennials are defined as individuals born between 1981 and 1986 (Fry, 2020). Understanding millennials' thought processes and communications preferences is crucial because they make up the largest living generation of adults in the United States (U.S.) and dominate a large share of purchasing and voting power (Fry, 2020; Parment, 2013).

Professional communicators must strategically utilize the platforms through which younger audiences are communicating and the values associated with the platforms (Pelletier et al., 2020) to effectively and strategically reach younger audiences through their preferred communication methods (Lee & Kotler, 2011). Millennials occupy a generational cohort that has become accustomed to a "constant and overwhelming flow of information" with the use of smartphones to multi-task and accomplish a variety of daily activities (Parment, 2013, p. 192), including social media platforms. With multitasking behavior comes the requirement to make decisions amidst a constant and ever-present wave of information (Parment, 2013).

Historically, members of the public searching for credible information across all age groups have trusted governmental or university websites for credible information over other online sources (Briggs et al., 2002). However, the abundant availability of Internet-based information has resulted in complex cognitive heuristic processes through which individuals assess information using various cues (Sundar, 2008). For example, one cue is the "authority heuristic" used in determining the level of credibility an online source should receive (Sundar, 2008, p. 84). Research has shown government-based websites and governmental experts trigger authority heuristics and result in higher perceived credibility on social media (Lin et al., 2016; Lin & Spence, 2018).

Given the high level of trust attributed to government- and university-based information sources, universities are challenged to take an active role in maintaining their credibility and communicating it appropriately with millennials online. Acknowledging millennials are accustomed to a continuous flow of information (Parment, 2013), younger audiences often rely on different cues than older generations to process and determine the communication quality of the content with which they are interacting (Han, 2018). Since social media leverages a dynamic, two-way communication process, universities need to establish source credibility and trustworthiness with millennials by leveraging "the social networks of target audiences" to

deliver "personal and interactive" messages (Lee & Kotler, 2011, p. 19). In order to appeal to the communication preferences of millennials and establish credibility amidst the complicated processes through which millennials evaluate trustworthiness, universities need to explore the characteristics of sources millennials find trustworthy on the social media networks on which they view news information (Pew Research Center, 2021a). Research related to source credibility in social media science communication, particularly from an academic institution, is limited and should be further explored by universities to reach millennial audiences effectively.

Literature Review and Conceptual Framework

Twitter in Agricultural Science Communication

Twitter is a micro-blogging social media platform that engaged a reported 187 million monetizable daily active users in 2020 (Twitter, Inc., 2020). Approximately one-in-five adults in the U.S. use Twitter (Pew Research Center, 2019a). Twitter users tend to have higher levels of education than the general population of U.S. adults and are also younger than the general U.S. population (Pew Research Center, 2019b). In 2020, 42% of U.S. adults between the ages of 18 and 29 and 27% of adults aged 30 to 49 reported using Twitter, while 18% of the U.S. population between ages 50 and 64 say they use the platform (Pew Research Center, 2021b). Millennials not only use Twitter to access news but communicate with brands through an established set of social norms that give social credit to both brands and the millennial users themselves (Sashittal et al., 2015).

Engagement on social media contains dimensions related to users' cognitive processes, emotions, and behaviors, which is difficult to fully measure. But one method in which an organization can analyze engagement is through measurable online behaviors of its customers (Muñoz-Expósito et al., 2017). Engagement on Twitter is often measured through industry benchmarks to help Twitter users determine how they compare against competitors in the same industry. Industry benchmarks include metrics such as engagement rate, frequency of posting, and types of media posted (Rival IQ, 2021). For example, Rival IQ (2021), found the higher education industry garnered the highest engagement rate per tweet among all industries active on Twitter in 2020. Higher education organizations had an average 0.087% engagement rate by follower, while the median across all industries was 0.045% (Rival IQ, 2021).

Research on Twitter conversations strive to understand how people are conversing about agricultural topics, scientific advancements in agriculture, and solutions being proposed around specific topics or events (Ruth et al., 2020; Specht & Buck, 2019; Wagler & Cannon, 2015; Wirz et al., 2020). For example, Wagler and Cannon (2015) used Twitter to identify themes in conversations about the 2012-2013 drought in Nebraska. In their study, not only did Twitter serve as a news source for agricultural producers, but non-agricultural individuals and organizations engaged in discussions about the drought's effect on the lives of the public. Universities were largely absent from the drought conversation on Twitter, implying education and engagement opportunities were missed (Wagler & Cannon, 2015).

Specht and Buck (2019) analyzed tweets and Twitter profiles to crowdsource solutions to food waste in the U.S. They identified influential members of "food-waste focused Twitter communities" and then determined geographic locations of those members (Specht & Buck, 2019, p. 10). They concluded that knowledge of online communities engaging in a conversation, in combination with their related influencers, can provide organizations with an opportunity to

engage with the influencers along with existing, enthusiastic audience members to glean "solutions, volunteers, and other resources" (Specht & Buck, 2019, p. 10).

Wirz et al. (2020) analyzed Twitter discourse around GM foods by the state of origin, finding the geographic location of the tweet's author did not predict the tweet's sentiment regarding GM foods. The sentiment of a tweet was instead predicted by its subject matter, and most states had more negative tweets about GMOs than positive or neutral (Wirz et al., 2020).

Twitter analytics have also been used as a tool to examine the effectiveness of communication approaches when reaching public audiences with a specific agricultural message. Metrics such as retweets, replies, and likes are the most common analytic measurements of Twitter engagement (Muñoz-Expósito et al., 2017). In one publication highlighting Twitter engagement metrics, a horticultural Extension specialist used his Twitter account to post weekly, strategic threads about specific fruit crops during COVID-19 shelter in place as the pandemic necessitated a shift from in-person education to online environments for Extension educators (Stafne, 2020). The analysis revealed an increase in engagement and followers and supported the idea that Extension professionals could potentially use Twitter as part of their educational appointments and report the use of Twitter as part of their job duties given the platform's quantitative data capabilities (Stafne, 2020). Stafne (2020) is one of only a few agricultural researchers who has published the analytics of a strategic, agriculturally focused social media campaign that occurred from a single account, rather than creating a fictitious campaign to distribute and evaluate within a controlled environment, performing a content analysis of an existing account (Kesler et al., 2021), or deriving insights from existing public online conversation (Ruth et al., 2020; Specht & Buck, 2019; Wagler & Cannon, 2015; Wirz et al., 2020).

However, science communication researchers have used live, strategic publication of social media posts from an existing university account to explore the influence of content type and content message framing on social media engagement, using Facebook instead of Twitter as the social media platform (McLeod-Morin et al., 2020). In their examination of mosquito control campaign social media posts McLeod-Morin et al. (2020) found text-focused graphics without animated authority figures received the highest levels of engagement, while text-focused graphics with animated authority figures garnered the lowest overall engagement according to Facebook metrics. However, inclusion of an authority figure within a graphic received higher engagement than a graphic without an authority figure (McLeod-Morin et al., 2020).

Source Credibility

Source credibility served as the conceptual framework for this study (Pornpitakpan, 2004). To convince a specific audience to adopt a message, perceived credibility can focus on five variables: "source, message, channel, receiver, and destination" with source and receiver being the most researched (Pornpitakpan, 2004, p. 243). Source credibility studies often analyze perceived credibility using scales developed to measure the expertise and trustworthiness of the source (Hovland et al., 1953). Expertise or "expertness" of a source is the degree to which a receiver believes a source to be "capable of transmitting valid statements" (Hovland et al., 1953, p. 21). Trustworthiness is the perceived confidence a receiver has in the source to communicate valid information (Hovland et al., 1953).

On social media, source credibility has been studied to explore a combination of factors a reader (or receiver) uses to determine a post's perceived credibility (Han, 2018; Lin et al., 2016;

Lin & Spence, 2018; Shariff et al., 2017). Shariff et al. (2017) found a reader's perception of a credible tweet can be influenced by their personal education level and geographic location. Han (2018) examined the heuristic cues Twitter users employ to determine the credibility of a source from which a tweet originates. The findings indicated perception of a source's credibility depended on the reader's age, gender, and frequency of social media use (Han, 2018).

Source credibility on social media has been of particular interest in the health and risk communication field. Lin et al. (2016) found individuals are most likely to seek health information from government social media accounts based on the significant effects of authority heuristics. A follow-up study identified users found a Food and Drug Administration expert's tweets to have higher levels of competence, goodwill, and trustworthiness than tweets of strangers or peers based on expert "authority identity" (Lin & Spence, 2018, p. 474).

Perceptions of race and source credibility are particularly complex. When exploring the impact of race on source credibility in health risk communication on Facebook, one study found Black avatars were perceived as more credible altogether when reposting a message, but the "specific combination of African American audiences viewing Caucasian avatars drew the greatest level of perceived credibility" (Spence et al., 2013a, p. 11). However, Black audiences did perceive both White sources and Black sources as more trustworthy than White audiences did altogether. Examination of study results additionally found Black sources were perceived as more trustworthy and caring but not as competent (Spence et al., 2013a). An additional study exploring response efficacy and behavior change intentions concluded that Black audiences were more likely to change risky health behaviors when receiving information from a Black Facebook avatar who displayed high ethnic identity rather than an avatar with low ethnic identity, supporting previous research that members of minority groups responded positively to messages specifically targeted at their own communities (Spence et al., 2013b). However, in the same study White respondents believed changing health behaviors, as suggested by the Black avatars, would be effective but were not willing to make the changes, suggesting a potential bias (Spence et al., 2013b).

Gender has been studied as to its effect on the reader's perception of the scientific source's credibility. Bigham et al. (2019) examined the role gender plays when determining if someone is perceived as an expert scientific source, and if that affected undergraduate millennials' perception of the source credibility. Surveys measuring dimensions of source credibility found gender of the source played a significant role in source credibility perception. Female researchers were perceived as more credible than male researchers (Bigham et al., 2019).

Studies on the influence of age on a source's credibility are limited. Hovland et al. (1953) asserted in his seminal work on source credibility that older individuals may benefit from the perception of more expertise than younger individuals. Weibel et al. (2008) found older male newscasters were considered the most credible than younger female newscasters in a study of newscasters in Switzerland.

Research has also examined how source credibility impacts agricultural communication efforts. Lamm et al. (2016) researched the impact of message source on public attitudes related to agriculturalists' use of water, comparing sources from different possible groups using an experimental design. Findings implied agricultural messages should be delivered from sources who are considered experts directly related to the content, such as farmers and conservationists (Lamm et al., 2016). Telg et al. (2012) conducted an exploratory qualitative study using focus groups to define which institutions and information sources farmers trusted most when receiving information about citrus greening. Focus group participants revealed reliance on neighboring

citrus producers for information and were reluctant to follow the guidance of universities or the U.S. Department of Agriculture because of negative past experiences (Telg et al., 2012).

Though source credibility has been explored in agricultural message development, research focusing on factors influencing social media source credibility in the agricultural science context is limited. Additionally, recent peer-reviewed studies in multiple disciplines have used fictitious representations of the social media experience constructed for the participants of online surveys rather than analyzing data from active accounts and found significant differences in message recipient perceptions of source credibility based on source characteristics (Lin & Spence, 2018; Shariff et al., 2017). This study strives to explore organic, existing data from a strategic and active Twitter account to describe differences among specific source characteristics using a practical application online from the lens of a research university.

Purpose and Objectives

The purpose of this study was to explore the differences in engagement when specific factors pertinent to source credibility are emphasized when communicating with millennials about agricultural science on Twitter from an agricultural and environmental research institution. The study was guided by the following research objectives:

1. Describe public level of engagement with agricultural science communication on Twitter.
2. Describe the differences in engagement when perceived gender, race, and age of the researcher are emphasized in agricultural science communication.

Methods

This exploratory study used an observational and descriptive design to curate Twitter posts that appeal to millennials, track engagement with those posts, and describe Twitter engagement differences, if any existed, of a source's perceived gender, race, and age on science communication tweets from an agricultural and environmental college at a university. Twitter was identified as a medium of choice for reaching millennials over social media because of its user base younger than the general U.S. population (Pew Research Center, 2021b). At the time of the study, Twitter did not allow for the division of followers by age in Twitter Analytics (Twitter Inc., San Francisco, California) and the millennial age of the audience was assumed.

Tweets were strategically crafted for dissemination from the University of Georgia's (UGA) College of Agricultural and Environmental Sciences (CAES) research Twitter account. The researchers identified topics for tweets by receiving Google Scholar alerts when peer-reviewed journal articles were published by faculty and graduate students associated with departments within college. The researchers reviewed articles to select topics that proportionally represented the college's five major research themes, as identified by Wilson (2020). According to Wilson's (2020) results, the research themes were "(1) *advances in plant sciences*, (2) *advances in animal sciences*, (3) *advances in food science and safety*, (4) *society's role in agricultural and environmental sciences*, and (5) *environmental resource management*" (p. 80). In selecting the articles, the researchers ensured more than one author from the college contributed to the publication. To test engagement related to the emphasized elements of gender, ethnicity, and age as related to source credibility, articles were also selected to ensure researcher diversity across these variables.

Once the articles were selected, agricultural communication students wrote press releases about them. The press releases were then published using the UGA CAES Newswire or UGA Today News during a seven-month period. UGA CAES Newswire is an online platform maintained by UGA CAES and UGA Cooperative Extension responsible for the publication of stories focused on agriculture, consumers, family, and the environment. UGA Today News is the official online news center for UGA under the Division of Marketing and Communications, publishing top news from across the university. Releases published on UGA Today News fit specific needs identified by the Division of Marketing and Communications and required additional edits before release. Press releases were published at regular intervals throughout the seven-month period, but the times and dates of publication were limited due to publication schedule restraints from the news sites. The lack of control over press release publication schedule presented a limitation in this study but social media accounts were maintained throughout the study to reduce impact.

Over the seven-month period, 12 press releases were published based on the results of the selected peer-reviewed research articles. Each press release contained quotes from two or more UGA CAES researchers. Based on the content of the article, tweets were crafted using Twitter best practices that aligned with UGA's social media branding guidelines. These best practices included the use of platform-appropriate high-quality graphics, relevant hashtags, social media scheduling tools, and UGA-affiliated account tags (see Figure 1). A total of 32 tweets were tweeted, each with a headshot photo of one researcher. Each tweet graphic contained the following: a cutout headshot of one researcher superimposed on a background photo related to the content of the press release, a UGA CAES Research logo, and the press release title. The tweets for each topic were identical with the exception of the researcher headshots, which were selected to emphasize the perceived physical characteristics of the source.

Figure 1

Examples of Scientist Tweets about Single Press Release

Tweets were written using language that would appeal to millennials by using positively framed phrases, popular hashtags, short sentences, and no more than one emoji per tweet while providing information about research findings. Each tweet met the 280-word character limit set by Twitter, tagged the official UGA CAES Twitter account, and used a unique research hashtag. Tweets also contained shortened links to their affiliated press releases. Each tweet was posted at 1 p.m. on a weekday between November 1, 2020 and May 3, 2021 using the Hootsuite scheduling platform (Hootsuite, Inc., Vancouver, Canada). During this time, the UGA CAES Research Twitter account had between 283 and 354 followers.

Tweets were categorized according to the following perceived physical attributes of the scientist featured in the graphic: male versus female, Non-White versus White, and older versus

younger. The variables were accounted for by validating the perceived characteristics of the scientists, verified by a panel of twelve millennials, representative of the target audience of the study. Panelists completed a survey one week after the completion of the Twitter campaign in which they identified if they perceived researchers as male versus female and Non-White versus White using binary selections. Panelists identified perceived researcher age with an age estimate number slider. For the purposes of this study, individuals perceived as age 41 and above were classified as older and individuals perceived as below the age of 41 were classified as younger because, as of 2021, individuals ages 41 and older were classified as generation X, baby boomers, or part of the silent generation (Fry, 2020).

To explore audience interaction with sources who had various perceived physical characteristics that may contribute to source credibility, Twitter engagement was used as the metric in this study. Engagement is the "manifestation of commitment, through the intensity of interactions and their implications, toward the offers and activities of a brand, product, or firm" (Muñoz-Expósito et al., 2017, p. 1128). Engagement data for each post were obtained through Twitter Analytics (Twitter Inc., San Francisco, California). The following forms of engagement were measured: retweets, likes, URL clicks, total engagement, and engagement rate by impressions. Retweets are the number of times a user retweeted a tweet (Twitter, Inc., n.d.). Likes are the number of times an individual Twitter user liked the tweet using (Twitter, Inc., n.d.) by pressing the heart icon. URL clicks are the number of times users click on URLs within a tweet (Twitter, Inc., n.d.). Total engagement is defined by Twitter as the total number of times any user clicks anywhere on a tweet, while engagement rate by impressions is measured by dividing engagement by the number of impressions a tweet makes (Twitter, Inc., n.d.). Impressions are the number of times unique users view a tweet within their Twitter timeline or search results. Engagement rate is calculated differently based on social media platform and the audience figures of impressions, reach, or even follower count (Ordioni, 2019). The present study uses engagement rate by impressions because it is the default measure of engagement rate from Twitter Analytics (Twitter, Inc., n.d.). Because impression data is only available to administrators of a Twitter account, engagement rate by impressions is considered a private measure of engagement. Engagement rate by followers, a public engagement measure, is useful in comparing performance of a Twitter account to that of a competitor – a useful tool for determining industry benchmarks. It is impossible to compare industry benchmarks with private engagement metrics; however, this study specifically focused on measuring the success of posts against one another within an account rather than against competing accounts. Additionally, previous studies of science communication using Twitter have found that private engagement data available only to account administrators – including URL clicks – are more relevant in determining true engagement of an account (Tomblinson et al., 2019). Finally, this study was carried out over the course of seven months, during which time follower count fluctuated. Native analytics tools on Twitter do not track followers for an account daily. Therefore, engagement rate by impressions was the most practical metric for the purposes of this study.

To adjust for possible differences in engagement based on the order of appearance a tweet made, tweets featuring researchers with different perceived characteristics were scheduled on a variety of weekdays. For example, if a tweet featuring a young, Non-White, female appeared first in a sequence of tweets about one press release, the next sequence of tweets would feature an older, White, male in the first post. Data were analyzed through SPSS 26 using descriptive statistics.

Results

Objective One

Objective one was to describe public level of engagement with agricultural and environmental science communication on Twitter. The descriptive research design analyzed the level of engagement with the 32 tweets using a variety of Twitter metrics (Table 1). Table 1 additionally contains details about the contents of each press release and the perceived characteristics its featured researchers.

Table 1

Press Release Information and Associated Twitter Engagement Metrics

Research theme, tweet subject, & researcher description	Retweets	Likes	Total engagements	Engagement rate (%)	URL clicks
Advances in plant sciences					
Hemp perceptions					
Older White Female	6	7	43	4.67	4
Younger White Male	2	3	17	6.16	4
Organic soybean nutrients					
Younger Non-White male	4	5	27	4.01	6
Younger White Female	8	11	54	3.85	13
Blue light and blueberries					
Younger Non-White Female	6	7	51	6.65	9
Older White Male	1	7	19	5.59	6
Older White Male	3	7	18	2.37	2
Younger Non-White Female	5	6	29	3.50	4
Precision planter settings					
Younger Non-White Male	5	20	49	4.83	7
Younger White Male	5	17	58	5.64	9
Advances in animal sciences					
Turfgrass predators					
Older Non-White Male	2	6	19	2.85	4
Younger Non-White Male	6	7	42	2.93	2
Poultry bone chemistry					
Older Non-White Male	4	3	37	3.77	9
Younger Non-White Female	1	4	8	2.79	2
Cows and heat stress					
Younger Non-White Female	5	10	47	3.92	9
Older White Male	5	8	44	6.25	7
Younger Non-White Male	3	4	13	2.53	2
Bee-friendly lawns					
Older White Female	2	6	17	5.00	3
Younger White Male	7	9	44	4.42	3
Older Non-White Male	4	10	49	2.45	18
Society's role in agricultural and environmental sciences					
Identifying animal industry issues					
Older White Male	4	8	31	2.11	9
Older White Male	3	4	23	2.73	4
Younger Non-White Female	5	10	115	4.50	20
Extension in Kenya and Malawi					
Younger White Female	2	5	17	3.39	2

Research theme, tweet subject, & researcher description	Retweets	Likes	Total engagements	Engagement rate (%)	URL clicks
Younger Non-White Female	7	8	32	7.46	4
Older White Male	4	6	17	5.12	3
Advances in food science and safety					
Pecan quality					
Older Non-White Male	3	6	19	2.19	3
Younger Non-White Male	3	5	23	4.28	1
Younger Non-White Female	4	6	33	3.02	0
Environmental resource management					
Biodegradable garden containers					
Younger White Female	2	2	14	3.84	0
Younger Non-White Female	4	6	33	2.73	0
Younger Non-White Male	6	7	100	5.24	4

Objective Two

When describing the differences in engagement by perceived gender of a researcher on agricultural and environmental science communication, descriptive analysis found posts with female researchers yielded a higher number of retweets ($M = 4.38$; $SD = 2.14$), higher levels of total engagement ($M = 37.92$; $SD = 27.36$) and a higher engagement rate by impressions ($M = 4.25\%$; $SD = 1.43\%$) than posts with male researchers. However, tweets highlighting male researchers received a slightly higher level of likes ($M = 7.47$; $SD = 4.35$) and URL clicks ($M = 5.42$; $SD = 3.96$) than those with female researchers (see Table 2).

Table 2

Frequencies of Tweet Engagement by Perceived Source Characteristics

Engagement Metric	Perceived Gender				Perceived Race				Perceived Age			
	Female (*n* = 13)		Male (*n* = 19)		Non-White (*n* = 18)		White (*n* = 14)		Older (*n* = 12)		Younger (*n* = 20)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Retweets	4.38	2.14	3.89	1.52	4.28	1.53	3.86	2.11	3.42	1.38	4.50	1.91
Likes	6.77	2.52	7.47	4.35	7.22	3.78	7.14	3.70	6.50	1.83	7.60	4.44
Total Engagement	37.92	27.36	34.16	20.95	40.33	27.59	29.71	15.61	28.00	12.14	40.30	27.38
Engagement Rate (%)	4.25	1.43	3.97	1.43	3.87	1.45	4.37	1.36	3.76	1.49	4.28	1.37
URL Clicks	5.38	5.91	5.42	3.96	5.78	5.62	4.93	3.50	6.00	4.45	5.05	5.01

Note. *n* = total number of tweets in the category.

Descriptive analysis was used to describe the differences in engagement with agricultural and environmental science communication tweets when perceived race was examined. Posts using Non-White researchers received higher levels of engagement including number of likes ($M = 7.22$; $SD = 3.78$), retweets ($M = 4.28$; $SD = 1.53$), total engagement ($M = 40.33$; $SD = 27.59$), and URL clicks ($M = 5.78$; $SD = 5.62$) than those with White researchers. However, engagement rate by impressions were slightly higher ($M = 4.37\%$; $SD = 1.36\%$) for posts with White researchers than those using Non-White researchers ($M = 3.87\%$; $SD = 1.45\%$; see Table 2).

Finally, descriptive analysis was used to examine the engagement differences present when perceived researcher age was observed in agricultural and environmental science

communication. Posts using younger researchers received higher levels of engagement across likes ($M = 7.60$; $SD = 4.44$), retweets ($M = 4.50$; $SD = 1.91$), and total engagement ($M = 40.30$; $SD = 1.37$) than those using older researchers. However, tweets featuring older researchers received more URL clicks ($M = 6.00$; $SD = 4.45$) than those with younger researchers (see Table 2).

Conclusions and Discussion

Strategic communication with a target audience is crucial to convey evidence-based information to the public (Fitzgerald et al., 2016), especially considering the general lack of trust in scientific innovations (Lang, 2013) and the complexity of the cognitive processes through which audiences determine a source's online trustworthiness (Lin et al., 2016; Lin & Spence, 2018). The purpose of this study was to explore the potential differences present between factors that influence source credibility when communicating with millennials about agricultural and environmental science on Twitter from a research institution. While exploratory in nature, the descriptive results indicated there were differences in engagement for each perceived characteristic of the featured researchers and may therefore be useful in informing future research.

There were a few limitations that should be addressed before the findings are further discussed. The research content in tweets was not necessarily controversial, and some subject matter, such as blueberries, seemed to perform better than others. While specific research content would be pertinent to explore in future research, for the purposes of this study, the researchers attempted to control for this limitation by featuring an array of research topics across the study.

Second, the timeline during which the tweets were published and data collected was amidst the COVID-19 global pandemic when media consumption and information-seeking habits about science communication may have shifted from pre-pandemic behaviors. Though none of the press releases and their resulting tweets dealt with COVID-19 research, it must be acknowledged that social media norms and attitudes during the time of a global health crisis could have influenced the way in which individuals engaged with and reacted to scientific information. Major U.S. political events, including a presidential election and congressional runoff election, took place during the study. Researchers refrained from posting within one or two days of major social events including U.S. elections, holidays, and periods of social unrest. However, as Twitter is a major source of news, any array of events may have affected the engagement of some posts more than others.

Next, since press releases for the study were published based on the availability of research publications with a demographically and disciplinary diverse set of scientists, the tweets did not contain equal numbers of scientists in the demographic categories and, therefore, may have affected the research outcomes. The availability of high-quality photos of scientists was also limited due to travel restrictions and remote working situations rendering it difficult to obtain photos of a consistent quality, which may have affected the engagement metrics.

Finally, this study is exploratory in nature and described engagement surrounding factors that have influenced source credibility in past research through the analysis of social media metrics. More extensive research on the followers themselves and their perception of the researchers depicted in the tweets would be necessary to assess the effect of race, gender, and age on follower perceptions of source credibility. Though the engagement metrics provide some interesting descriptive metrics to be interpreted from a research standpoint, the standard

deviations were consistently high within the results and must be considered as a limitation. Additionally, Twitter does not allow for the segmentation of followers by age group. Therefore, there is an assumption that the followers themselves were younger based upon Twitter user demographics (Pew Research Center, 2019b). Additional geographic and demographic knowledge about Twitter followers was also limited due to Twitter's limited provision of follower data at the time of the study. Therefore, the findings of this study may not be generalizable. Followers may have already held an interest in agriculturally and environmentally relevant academic research or were connected in some way to the institution – most likely residents of the state in which the university is located or alumni of the college. Followers may have had existing relationships with scientists featured in the tweets. Considering these limitations, this exploratory study exhibited findings that can inform future research and contribute ideas to the development of strategic Twitter campaigns.

When analyzing engagement according to the perceived gender of the researcher, tweets with female researchers yielded higher engagement rate levels but did not receive as many likes and URL clicks as their male counterparts. The higher engagement with posts containing females aligns with the findings of Bigham et al. (2019) that female researchers are perceived as more credible overall. Perhaps the difference in gender and engagement is related to the smaller number of female researchers featured. All 12 of the press releases featured at least one male, but two press releases did not feature any female researchers. In identifying potential journal articles to feature in press releases, it was difficult to ensure female authors were included. Thus, universities may benefit from examining the diversity in gender of their researchers while considering the slightly higher levels of social media engagement with featured female scientists.

When perceived race was examined, tweets with the highest engagement rate were from White researchers, but the tweets from Non-White researchers performed better in every other engagement metric identified. The nuance in these engagement scores emphasizes racial diversity is important in providing scientific messages to engage Twitter audiences but requires further research to fully understand. If engagement does reflect perceived source credibility, these nuanced findings align with Spence et al.'s (2013a) results that White sources were perceived as more credible than Black sources by Black audiences because Black sources were not rated as high in the measure of confidence. Additionally, for the purpose of this study, perceived race of sources was only segmented as White and Non-White. The particular perceived race of a source may have played a role in engagement. Additionally, there may have been an outlier that resulted in higher engagement rates for one tweet based on the number of impressions received by the certain tweet. The further segmentation of race and exploration of its effects on engagement should be considered in future studies.

Tweets featuring photos of younger sources received higher levels of engagement in retweets, likes, total engagement, and engagement rate than tweets with older researchers, Because Twitter users tend to be younger (Pew Research Center, 2019b), users may be more prone to engage with messages shared from researchers who share similar characteristics to their own. Though age may be positively associated with expertise (Weibel et al., 2008), trustworthiness in researchers related to agricultural advancements is complex as to their ability to deliver accurate, unbiased information about the effects of agricultural technologies on people and the environment (Hunt & Wald, 2020). If engagement aligns with perceived credibility, higher level of social media engagement with younger sources could be a result of the Twitter audience trusting scientists of their own age to deliver unbiased or relevant information.

The exploratory insights gained from this study may provide practical implications for science communication practitioners as well as a framework for shaping future research objectives. Though the findings of this study are strictly descriptive, universities should consider testing the use of scientists diverse in perceived characteristics in their own Twitter communications to gauge the effects on engagement with their specific audiences. Since millennial women typically have lower trust in agricultural technology advancements (Hunt & Wald, 2020) and perceive female sources as more credible in the delivery of scientific messages (Bigham et al., 2019), the higher level of engagement with female sources may indicate universities should consider featuring female researchers who work on potentially controversial scientific topics when delivering evidence-based, but controversial information on Twitter. Universities should also emphasize the work of younger researchers on Twitter to appeal to the younger audience on the platform and encourage engagement that may play a role in increasing interest in agricultural research topics. Universities with graduate researchers are uniquely positioned to create targeted messages for Twitter featuring younger researchers because peer-reviewed journal articles are often authored with the help of graduate student researchers and faculty members who may be perceived as older. For Twitter specifically, universities should consider the utilization of graduate student researchers under the age of 41 to deliver research messages and increase engagement. Science communication practitioners from a research institution should also consider strategically and proportionally featuring researchers of diverse racial backgrounds throughout their social media efforts to further explore the effects of these features on social media engagement. Practitioners may also consider partnering with offices or departments at their institutions that prioritize racial diversity and inclusion to accomplish this strategically.

The organic nature of the content within this study and its limited number of featured scientists, topics, and tweets necessitates further examination. The direct relationship between source credibility and social media engagement cannot be proven through descriptive, exploratory measures but rather explored. Thus, future research is needed to analyze the relationships between the higher engagement rates of female, Non-White, younger researchers and valid measures of source credibility. The knowledge gained in the present study should provide insights to inform future research in which dimensions of source credibility are measured under controlled experimental conditions with a larger sample size to contribute to the body of literature on social media source credibility within target audiences specifically related to agricultural and environmental science communication. Future research could determine the best combination of perceived gender, race, and age to deliver a scientific message to a Twitter audience and, thus, be used in the dissemination of particularly impactful research results from universities. Focus groups or surveys could be used to determine the specific characteristics of the sources and what Twitter users identify as credible, as well as gather information about the Twitter audiences themselves to provide more in-depth insights about segmented audiences. Specifically, future research could determine if predispositions toward agricultural topics, Twitter use, age, or geographic location play a role in a message recipient's perceptions of university scientists' source credibility and use those findings to craft communications strategy accordingly. Additionally, research of this nature does not have to be confined to Twitter. Universities may benefit from conducting similar source credibility studies across social media platforms such as Instagram, Facebook, or LinkedIn to determine if engagement differs across platforms according to the university's communication goals. This understanding could benefit

universities in strategically preparing their content for a variety of social media platforms while wisely utilizing the principles of source credibility.

References

Bigham, A., Meyers, C., Li, N., & Irlbeck, E. (2019). The effect of emphasizing credibility elements and the role of source gender on perceptions of sour credibility. *Journal of Applied Communications, 103*(2). https://doi.org/10.4148/1051-0834.2270

Briggs, P., Burford, B., De Angeli, A., & Lynch, P. (2002). Trust in online advice. *Social Science Computer Review*, *20*(3), 321-332. https://doi.org/10.1177/089443930202000309

Burke, K., Boman, C. D., D'Angelo, J., & Ellis, J. D. (2020). Using audience segmentation to determine millennial perceptions toward GM foods. *Journal of Applied Communications, 104*(4). https://doi.org/10.4148/1051-0834.2342

Fitzgerald, H. E., Bruns, K., Sonka, S. T., Furco, A., & Swanson, L. (2016). The centrality of engagement in higher education. *Journal of Higher Education Outreach and Engagement, 20*(1), 223-244. https://files.eric.ed.gov/fulltext/EJ1097192.pdf

Fry, R. (2020). *Millennials overtake Baby Boomers as America's largest generation.* https://www.pewresearch.org/fact-tank/2020/04/28/millennials-overtake-baby-boomers-as-americas-largest-generation/

Han, K. (2018). How do you perceive this author? Understanding and modeling authors' communication quality in social media. *PLOS ONE, 13*(2). https://doi.org/10.1371/journal.pone.0192061

Hovland, C. I., Janis, I. L., & Kellye, H. H. (1953). *Communication and persuasion*. Yale University Press.

Hunt, K. P., & Wald, D. M. (2020). The role of scientific source credibility and goodwill in public skepticism toward GM foods. *Environmental Communication, 14*(7), 971-986. https://doi.org/10.1080/17524032.2020.1725086

Kesler, K. R., Hall, K., Spielmaker, D., Roslynn G. H., & McCann, B. (2021). Building engagement in Facebook: A case study with Utah State University Extension Sustainability. *Journal of Applied Communications, 105*(1). https://doi.org/10.4148/1051-0834.2354

Lamm, A. J., Owens, C. T., Telg, R., & Lamm, K. W. (2016). Influence of source credibility on agricultural water use communication. *Journal of Applied Communications, 100*(3). https://doi.org/10.4148/1051-0834.1235

Lang, J. T. (2013). Elements of public trust in the American food system: Experts, organizations, and genetically modified food. *Food Policy, 41*, 145-154. https://https://doi.org/10.1016/j.foodpol.2013.05.008

Lee, N. R., & Kotler, P. A. (2011). *Social marketing: Influencing behavior for good* (4th ed.). Sage.

Lin, X., Spence, P. R., & Lachlan, K. A. (2016). Social media and credibility indicators: The effect of influence cues. *Computers in Human Behavior, (63)*, 264-271. https://doi.org/10.1016/j.chb.2016.05.002

Lin, X., & Spence, P. R. (2018). Identity on social networks as a cue: Identity, retweets, and credibility. *Communication Studies, 69*(5), 461-482. https://doi.org/10.1080/10510974.2018.1489295

Martin, J. M., Hill, R. L., Van Sandt, A., & Thilmany, D. D. (2016). Colorado residents trusted sources of agricultural, biotechnology, and food information. *AgBioForum, 19*(1), 34-43. https://agbioforum.org/colorado-residents-trusted-sources-of-agricultural-biotechnology-and-food-information/

McLeod-Morin, A., Beattie, P., Rampold, S., & Telg, R. (2020). Exploring social media engagement of a mosquito control campaign: Comparing engagement rates per content type and content frame. *Journal of Applied Communications, 104*(1). https://doi.org/10.4148/1051-0834.2299

Muñoz-Expósito, M., Castellanos-Verdugo, M., & Oviedo-García, M. Á. (2017). How to measure engagement in Twitter: Advancing a metric. *Internet Research, 27*(5), 1122-1148. https://doi.org/10.1108/IntR-06-2016-0170

Ordioni, J. (2019, September 17). *How to calculate your social media engagement rate.* ERE Recruiting Intelligence. https://www.ere.net/how-to-calculate-your-social-media-engagement-rate/

Parment, A. (2013). Generation Y vs. Baby Boomers: Shopping behavior, buyer involvement and implications for retailing. *Journal of Retailing and Consumer Services, 20*(2), 189-199. https://doi.org/10.1016/j.jretconser.2012.12.001

Pelletier, M. J., Krallman, A., Adams, F. G., & Hancock, T. (2020). One size doesn't fit all: A uses and gratifications analysis of social media platforms. *Journal of Research in Interactive Marketing, 14*(2), 269-284. https://doi.org/10.1108/jrim-10-2019-0159

Pew Research Center. (2019a, April 10). *Share of U.S. adults using social media, including Facebook, is mostly unchanged since 2018* [Report]. https://www.pewresearch.org/fact-tank/2019/04/10/share-of-u-s-adults-using-social-media-including-facebook-is-mostly-unchanged-since-2018/

Pew Research Center. (2019b, April 24). *Sizing Up Twitter Users* [Report]. https://www.pewresearch.org/internet/2019/04/24/sizing-up-twitter-users/

Pew Research Center. (2021a, January 12). *News use across social media platforms in 2020* [Report]. https://www.journalism.org/2021/01/12/news-use-across-social-media-platforms-in-2020/

Pew Research Center. (2021b, April 7). *Social Media Fact Sheet.* https://www.pewresearch.org/internet/fact-sheet/social-media/?menuItem=d102dcb7-e8a1-42cd-a04e-ee442f81505a#who-uses-each-social-media-platform

Pornpitakpan, C. (2004). The persuasiveness of source credibility: A critical review of five decades' evidence. *Journal of Applied Social Psychology, 34*(2), 243-281. https://doi.org/10.1111/j.1559-1816.2004.tb02547.x

Rival IQ. (2021, February 16). *2021 social media industry benchmark report*. https://www.rivaliq.com/blog/social-media-industry-benchmark-report/

Ruth, T. K., Suits, T., McLeod-Morin, A., & Telg, R. W. (2020). Utilizing Twitter to communicate risk after a natural disaster. *Journal of Applied Communications, 104*(1) https://doi.org/10.4148/1051-0834.2301

Sashittal, H. C., Hodis, M., & Sriramachandramurthy, R. (2015). Entifying your brand among Twitter-using millennials. *Business Horizons, 58*(3), 325-333. https://doi.org/10.1016/j.bushor.2015.01.010

Shariff, S. M., Zhang, X., & Sanderson, M. (2017). On the credibility perception of news on Twitter: Readers, topics and features. *Computers in Human Behavior, 75*, 785-796. https://https://doi.org/10.1016/j.chb.2017.06.026

Smith, K. T. (2010). An examination of marketing techniques that influence Millennials' perceptions of whether a product is environmentally friendly. *Journal of Strategic Marketing, 18*(6), 437-450. https://doi.org/10.1080/0965254X.2010.525249

Smith, K. T., & Brower, T. R. (2012). Longitudinal study of green marketing strategies that influence millennials. *Journal of Strategic Marketing, 20*(6), 535-551. https://doi.org/10.1080/0965254X.2012.711345

Specht, A. R., & Buck, E. B. (2019). Crowdsourcing change: An analysis of Twitter discourse on food waste and reduction strategies. *Journal of Applied Communications, 103*(2), 1-15. https://doi.org/10.4148/1051-0834.2240

Spence, P. R., Lachlan, K. A., Spates, S. A., & Lin, X. (2013a). Intercultural differences in responses to health messages on social media from spokespeople with varying levels of ethnic identity. *Computers in Human Behavior, 29*(3), 1255-1259. https://doi.org/10.1016/j.chb.2012.12.013

Spence, P. R., Lachlan, K. A., Westerman, D., & Spates, S. A. (2013b). Where the gates matter less: Ethnicity and perceived source credibility in social media health messages. *Howard Journal of Communications, 24*(1), 1-16. https://doi.org/10.1080/10646175.2013.748593

Stafne, E. T. (2020). #YardFruits: Twitter as a tool to disseminate horticulture education during a pandemic. *HortTechnology, 30*(6), 706-708. https://doi.org/10.21273/HORTTECH04717-20

Sundar, S. S. (2008). The MAIN model: A heuristic approach to understanding technology effects on credibility. In M. J. Metzger & A. J. Flanagin (Eds.), *Digital media, youth, and credibility* (pp. 73 - 100). The MIT Press.

Telg, R., Irani, T., Monaghan, P., Chiarelli, C., Scicchitano, M., & Johns, T. (2012). Preferred information channels and source trustworthiness: Assessing communication methods used in Florida's battle against citrus greening. *Journal of Applied Communications, 96*(1). https://doi.org/10.4148/1051-0834.1147

Tomblinson, C. M., Wadhwa, V., Latimer, E., Gauss, C. H., & McCarty, J. L. (2019). Publicly available metrics underestimate *AJNR* Twitter impact and follower engagement. *American Journal of Neuroradiology*, *40*(12), 1994–1997. https://doi.org/10.3174/ajnr.A6299

Twitter, Inc. (n.d.). *Tweet and Video Activity Dashboards*. Twitter Business. https://business.twitter.com/en/help/campaign-measurement-and-analytics/tweet-activity-dashboard.html

Twitter, Inc. (2020, October 29). *Twitter announces third quarter 2020 results* [Press Release]. https://s22.q4cdn.com/826641620/files/doc_financials/2020/q3/Q3-2020-Earnings-Press-Release.pdf

Wagler, A., & Cannon, K. J. (2015). Exploring ways social media data inform public issues communication: An analysis of Twitter conversation during the 2012-2013 drought in Nebraska. *Journal of Applied Communications, 99*(2). https://doi.org/10.4148/1051-0834.1047

Weibel, D., Wissmath, B., & Groner, R. (2008). How gender and age affect newscasters' credibility—An investigation in Switzerland. *Journal of Broadcasting & Electronic Media, 52*(3), 466-484. https://doi.org/10.1080/08838150802205801

Wilson, M. C. (2020). *Using knowledge as a product for effective science communication: evaluating how a land-grant university's college of agriculture communicates with the public* (Publication No. 2413387895) [Master's thesis, University of Georgia]. ProQuest

Dissertations & Theses Global.

Wirz, C., Howell, E., Brossard, D., Xenos, M., & Scheufele, D. (2021). The state of GMOs on social media: An analysis of state-level variables and discourse on Twitter in the United States. *Politics and the Life Sciences, 40*(1), 40-55. https://doi.org/10.1017/pls.2020.15